shortly after germination, the mycelium coming from the seed coat which is infected while still in the ovary. In sterile cultures there is a complete arrest of root development. It is concluded that the so-called soil preference of *Calluna* depends upon the maintenance of a biological balance between the roots and the root fungi. The disturbance of this balance in soils rich in lime is responsible for poor growth in such soils. Probably also the increased bacterial growth in the chalk cultures is detrimental. It is to be hoped that the author will make a comparative study of *Calluna* in its ordinary habitat, where the soil is acid and infertile.—H. C. COWLES.

A new Tylodendron.—WEISS[11] has described a new form of *Tylodendron* under the name *T. Cowardi*. Particular interest in this specimen centers around the secretory canals and primary wood. WEISS says: "The outer portions of the pith have very numerous secretory canals with dark brown contents, very like those found in the Medullosae, in cycads, and also in the pith of *Poroxylon*. These have not been observed or described, so far as I know, in any other specimens of *Tylodendron* showing structure." There are also isolated groups of primary xylem at the periphery of the pith as in *Pitys antiqua*, but much smaller. Analogous structure is seen in *Mesopitys* of ZALESSKY and in *Cycadeoidea* of WIELAND. With regard to the systematic position of this *Tylodendron*, WEISS agrees with POTONIÉ that *Tylodendron* is of araucarian affinity. He considers that the pitting of the secondary wood, the double leaf traces, etc., are araucarian or cordaitean in character, and homologizes the secretory ducts in the pith with those in the same region of the cone of *Araucaria* and the stem of *Poroxylon*. WEISS further considers that since a *Tylodendron* has recently been described with discoid pith like the Cordaiteae, considerable light is thrown on the connection between the cordaitean and the araucarian forms, and that the study of this genus promises much along this line in the future.—R. B. THOMSON.

Plant invasion on Hawaiian lava flows.—Thanks to the initiative of TREUB, we are now well informed as to the revegetation of Krakatau. The successive lava flows from Mauna Loa, the age of many of which is exactly known, afford an excellent opportunity for comparable investigations. The results of a preliminary study of this sort are given by FORBES.[12] As is well known, the lava here is of two well defined sorts, the *pahoehoe*, which has a smooth and satiny exterior and may be ropy, and the *aa*, which has a cavernous and jagged exterior. On a lava flow of 1859, no vascular plants were found on the *aa*, though the surface was often white with lichens. To FORBES' surprise,

[11] WEISS, F. E., A *Tylodendron*-like fossil. Mem. Proc. Manchester Phil. Soc. **57**: pp. 14. *pls.* 2. 1913.

[12] FORBES, C. N., Preliminary observations concerning the plant invasion on some of the lava flows of Mauna Loa, Hawaii. Occasional papers of the Bernice Pauahi Bishop Museum of Polynesian Ethnology and Natural History **5**:15–23. 1912.

the smooth *pahoehoe* was much more richly covered with vegetation, which occurred, however, only in cracks. On a 1907 flow plants were found just beginning to be established. The author concludes that on both types of lava, the first pioneers are lower cryptogams; on the *pahoehoe* these are soon succeeded by ferns and seeds plants, but on the *aa* there is a long-enduring lichen stage. Ultimately the natural forest of the region returns, except in places where man's influence causes the successful invasion of a naturalized flora. The *ohia* (*Metrosideros polymorpha*) is the dominating tree at first, and the *koa* (*Acacia koa*) is the dominating tree of the ultimate or climax forest.—H. C. COWLES.

Rainfall and soil moisture.—In studying the conditions which govern the plant activities of the semi-arid region about the Desert Laboratory, Tucson, Arizona, SHREVE[13] has made weekly determinations of the soil moisture at depths of 3, 15, and 30 cm. throughout the year, and compared the resulting data with the record of the rainfall for the same period, in order to see exactly how the former is affected by the latter. It is evident that precipitation of less than 0.15 inch has no effect upon the soil moisture, and that therefore there are periods of 140 days in the region under consideration without rainfall of sufficient amount to increase the moisture in the soil. This serves to indicate that in desert regions by no means all of the small rainfall is significant to vegetation as a source of water supply. The evaporation has been determined and plotted along with its ratio to the soil moisture, the march of soil moisture throughout the year, and the distribution of rainfall, making an instructive and detailed chart of those moisture factors which affect vegetation. Among other things it proves the range of moisture conditions at the Desert Laboratory to be one of great extremes.—G. D. FULLER.

Drought resistance in Hopi maize.—For centuries the Indians of New Mexico and Arizona have grown a race of maize in soil that is much too dry for the ordinary races of the species. A large factor in the success of this race, known as Hopi maize (from the Hopi Indians), is the extraordinary capacity for elongation possessed by the mesocotyl.[14] The Indians are accustomed to plant their maize at a depth of 15–45 cm.; this depth is for most varieties too great for effective germination. In ordinary races the mesocotyl can rarely be forced to grow to a length greater than 10 cm., whereas a length of 36 cm. can be induced in Hopi maize. Another advantage in the mesocotyl of Hopi maize is its ability to produce roots, a rare phenomenon in grass internodes. A third feature of great importance is the great elongation of the primary root

[13] SHREVE, F., Rainfall as a determinant of soil moisture. Plant World **17**:9–26. *figs. 3.* 1914.

[14] COLLINS, G. N., A drought-resisting adaptation in seedlings of Hopi maize. Jour. Agric. Research **1**:293–302. *figs. 2. pls. 29–32.* 1914.